NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

AQUACULTURE PONDS

(Ac.)

CODE 397

DEFINITION

A water impoundment constructed and managed for commercial aquaculture production.

PURPOSE

Provide a favorable aquatic environment for producing, growing, harvesting, and marketing commercial aquaculture crops.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to:

- All impoundments that store water and are managed for commercial aquaculture purposes.
- ***On land where soil conditions, water resources, and topography are suitable for constructing a pond or reservoir.***
- Embankment impoundments that do not exceed the requirements for Class (a) dams having a product of storage times effective height of dam less than 3,000 acre-ft^2 and effective height of dam less than 35 feet, as defined in conservation practice standard 378, Pond.

CRITERIA

General Criteria

Planners are encouraged to work with the appropriate state staff specialists and aquaculture specialists from the WVU Extension Service when utilizing this standard.

A thorough aquaculture resource assessment shall be made to determine the feasibility of the project prior to design. ***Contact the WVU Aquaculture Extension Specialist to initiate an assessment.***

NOTE: Commercial fish producers and fee fishing operators are required to obtain licenses and/or permits from the West Virginia Department of Natural Resources and/or the WV Division of Environmental Protection. Also, permits may be required to discharge water from commercial ponds into streams. Refer to Appendix I for permit and contact information.

The impoundment site should be made accessible for harvesting equipment. In the case of fee fishing enterprises, the facilities may also be designed to facilitate recreational fishing.

The site must be protected from flooding, sedimentation, and non-sediment contamination.

Acid soils shall be limed to achieve a neutral condition or the desired pH level for best production.

When multiple ponds are installed, each pond shall be arranged so that it can be managed independently of the others to facilitate harvesting and the control of parasites and disease.

All ponds shall be designed to minimize the escape of harmful fishery species to ***adjacent*** waters.

A protective cover of vegetation shall be established on all exposed soil surfaces that have been disturbed. If soil or climatic conditions preclude the use of vegetation, other protection methods shall be used.

Ponds will be constructed as specified in the WV conservation practice standard Pond (378). In addition, the following criteria will be incorporated into the design for the intended use. Aquaculture ponds may be: (1) embankment ponds that intercept and store surface runoff water, or (2) off-channel impoundments or excavated ponds that are filled by pumping ground water, or diverting spring or stream flows. ***Note: excavated ponds are often difficult to drain and may require the use of a pump.***

The standards and specifications for Dike (356), Dam, Diversion (348), Diversion (362), Grade Stabilization Structure (410), Grassed Waterway (412), Lined Waterway or Outlet (468), Pond Sealing or Lining (521), Pumping Plant for Water Control (533), Water Harvesting Catchment (636), and Structure for Water Control (587) may also be used as appropriate. Refer to the NEH part 650 Engineering Field Handbook for additional design information.

Water supply. Any available water source may be used if the quality and quantity are adequate. If water is pumped from rivers and streams or other sources where undesirable fish, pesticide residue, fish disease, and parasites may be introduced, filters must be installed in the pumping system.

Evaporation rates, fish-stocking densities, and species requirements shall be used in establishing specific incoming flow rates.

Water Quality. Water entering the pond shall be aerated to increase dissolved oxygen and dissipate harmful gases if needed. The minimum dissolved oxygen level in ponds is 3 to 5 parts per million.

Water temperature and water chemistry shall be suitable for use for fish-stocking density and species requirements in the planned aquaculture production.

Incoming water shall be added as far away from outlet drain as possible to prevent the rapid removal of fresh water from the pond.

Provisions shall be made for any needed treatment of water released downstream from the aquaculture impoundment structure.

All federal, State and local regulations will be followed and necessary permits will be obtained prior to construction and stocking.

Design Criteria – Embankment Ponds. Earthfill dams and embankments around excavated ponds shall meet or exceed the requirements for embankments specified for Pond (378).

The minimum top width of the embankment shall be 14 feet, where it is to be used as a road for harvesting, feeding, and management purposes and is nonpublic.

Design Criteria – Excavated Ponds. Ponds established by excavating and constructing an embankment around their outer perimeter that excludes outside runoff shall have either an auxiliary spillway or a principal spillway pipe installed with sufficient capacity to remove a 10-year/24-hour direct rainfall amount in 48 hours. A minimum 8-inch diameter pipe shall be used.

Levee construction shall add the required embankment settlement to the minimum freeboard requirements. A minimum berm width of 10 feet shall be provided between the outside toe of levee and top of bank of outlet drainage ditch.

Pipes and Conduits. Pump discharge through levees shall be installed above expected high water level, and provisions shall be made to prevent pump and motor vibrations from being transmitted to discharge conduits.

Interior embankments constructed for division of water or to direct water flow for circulation shall have adequate cross section to ensure stability and function for its intended purpose.

Adequate provisions must be made to protect earth surfaces from turbulent water at pipe inlets and outlets.

Pond Size and Depth. The pond shall be constructed to the recommended size and depth for the species to be grown. ***Refer to the specific depth criteria in this standard as described for bait fish, catfish or trout ponds.***

Drains. All ponds shall have facilities for complete as well as partial drawdown. Turn-down pipes, quick-release valves, bottom-water release sleeves, or other devices for

water level control and pond management are to be included in the construction of the drawdown facility as appropriate. Conduit design and seepage control shall meet or exceed the requirements specified for Pond (378).

Pond bottom. Where fish are harvested by seining, the pond bottom shall be smooth and free of all stumps, trees, roots, and other debris. Existing channels and depressions in the pond area shall be filled and smoothed. The edges of the pond should be deepened to provide at least 3 feet of water.

The pond bottom shall be sloped to the outlet at a gradient of at least 0.2 foot per 100 feet.

Access and safety. Provisions shall be made for access to the site as well as access for operation and maintenance. The access ramps, if provided, shall have a grade for equipment access of 4 horizontal to 1 vertical or flatter.

Appropriate safety features shall be made available nearby to aid people who may fall into the pond and devices installed to prevent such accidents.

Fences shall be installed as necessary to exclude livestock and unwanted traffic. ***Refer to WV conservation practice standard Use Exclusion (472).***

<u>Additional Criteria for Bait Fish Ponds</u>

Ideal locations for bait ponds are relatively flat or gently sloping areas of bottom land. (Avoid areas subject to overflow from creeks or rivers.) Subsoil should be compact enough to prevent excessive seepage. Ponds should be located as to ensure filling by gravity flow from the water source.

Ponds from 1/4 to 1/2 acres in size are most desirable; however, slightly larger or smaller ones may be designed where needed. Ponds exceeding 1 acre are impracticable due to difficulty in handling large numbers of minnows when draining to harvest.

The maximum depth should not be greater than 4 to 5 feet. The edges should slope rapidly to a depth of 3 feet (i.e. not exceed 2:1).

Catch basins shall be designed at the drain pipe in the deepest part of the pond and be a minimum of 15 feet square in size. The basin should be a minimum of 12 inches deep. Pond bottoms shall be graded so that the last of the fish and water will be in the catch basin during harvest. The walls of the basin shall be constructed of concrete or concrete blocks. The floor shall be at least 4 inches of concrete.

The water source shall be free of silt and sediment and of sufficient quantity at all seasons of the year to meet the desired levels of production. For economy, the water source should be situated so that all ponds may be filled by gravity flow. Consult the appropriate technical specialists for assistance to determine capacities of needed storage facilities.

Water should be periodically tested for chemical and organic pollutants. If the pond is filled by runoff it may be necessary to divert water originating at pollution sources.

Production of bait minnows requires that the ponds be kept free of other species of fish. Devices such as gravel filters may be required to exclude newly-hatched fry or other species of bait fish. A screen filter must also be placed over the drain inlet to prevent loss of fish into adjoining waters. (Consultation with the state engineering staff and/or Aquaculture Extension Specialist for proper design of filter and supply system is required.)

Table 1 below lists recommended species and stocking rates for bait fish ponds. Refer to the state staff biologist, WVU Extension Service aquaculture specialist or the WV Division of Natural Resources fisheries biologist for stocking rates of other species of bait fish.

SPECIES	STOCKING RATE PER SURFACE ACRE
Golden Shiners	300-400
Fathead Minnows	600-700

Table 1. Stocking rates for Fathead minnows and Golden shiners for bait fish ponds.

If aquatic vegetation is desired for spawning habitat, water level should be dropped in the spring (March) to permit the growth of grasses and other vegetation. Artificial spawning devices can be provided as follows:

- ***Golden Shiners - Place square bales of straw or hay in the pond with water covering them to a depth of one foot. Use 4 to 5 bales per ¼ surface acre. Anchor bales with stakes or weights to prevent drifting and remove them after spawning.***

- ***Fathead Minnows - Place 2 to 4 untreated spawning boards (l" x 4", approximately 6 feet long) along the edge of the pond at a depth of 1 to 2 feet. Attach boards to the top of stakes driven into the bottom so they are approximately six inches from the bottom.***

<u>Additional Criteria for Trout Ponds</u>

Note: Intensive trout production is not generally feasible in ponds. Landowners interested in such enterprises should consider development of fish raceways.

Water temperature must not exceed 70° F. (In summer, the surface water temperature may occasionally rise to 75 or 80° F for two or three hours on the few hottest afternoons. However the temperature must be lowered to 70° F or less by the following morning.)

Total alkalinity should be in the range of 50-150 ppm $CaCO_3$ equivalent unless supplemental feeding is to be conducted. Lower alkalinity (40 ppm) may be tolerated where supplemental feeding is conducted.

The pH limits for production of trout is 6.5 - 9.0.

One-third of the surface area shall be at least 6 feet deep with a portion at least 8 feet deep. The 8 foot requirement may be waived when a spring having a flow exceeding 50 gallons per minute per surface acre of water is the source.

A dependable supply of water is essential for commercial trout ponds where supplemental feeding is practiced. The following sources are listed in order of preference:

1. ***springs***
2. ***wells***
3. ***streams***

Water sources must be free of undesirable fish when it enters the pond. At least 50 gallons per minute per surface acre must be available from the source.

The pond size shall be determined by the water source. Runoff or bypass ponds shall be a minimum of 1/4 surface acre. For spring fed ponds the minimum size shall be 1/10 surface acre.

<u>Additional Criteria for Catfish Ponds</u>

Water temperature must be 70° F and above for at least 140 days. (Note: Catfish grow more slowly in water with temperatures between 60 and 70° F and practically stop growing when water temperature falls below 50° F.)

Bottom water outlets produce warmer summer water temperatures and thereby increase the length of the growing season. Refer to the NEH part 650 Engineering Field Handbook for additional design information.

The pH limits for production of catfish is 6.5 – 9.0.

The pond size shall be ¼ acre or more. Ponds 1-2 acres are more easily managed and harvested.

Pond depth must be at least 3 feet at the upper end and sides, sloping to 6 or more feet ($^1/_3$ of the surface area) at the drain gate outlet. Pond shorelines should slope 2:1 to a depth of 3 feet.

A dependable water supply is essential for commercial fish ponds where supplemental feeding is practiced. The following sources are listed in order of preference:

1. ***wells***
2. ***springs***
3. ***streams***
4. ***runoff ponds***

At least 25 gallons per minute per surface acre of pond shall be available from the source. If surface runoff is the only source of water, storage reservoirs above the rearing ponds may be required. Such reservoirs should have twice the capacity of the rearing ponds. Refer to WV conservation practice standard Water Harvesting Catchment (636) for more information.

Ponds, where supplemental feeding is practiced, must have control of water entering and leaving the pond. Aeration or other treatment may be necessary for treating water prior to release. Permits may be required for this activity and will specify the condition and quality of the water prior to release. Discharges may not exceed what is specified by the permit.

Harvesting basins, deepened 18 to 24 inches below the main pond bottom, may be desirable for final harvesting. If installed, they should be 10 percent of the total bottom area. Special care to assure a smooth bottom surface will aid in harvesting fish.

Installed drain pipes should be large enough to permit rapid drainage (complete drainage in 24 to 36 hours.) A 4 inch drain will generally handle ponds up to three acres in size.

CONSIDERATIONS

The West Virginia Division of Natural Resources or appropriate West Virginia University Extension Service agent should be contacted for recommendations on pond size, water depths, and adapted commercial aquatic species. (See references for WVU Aquaculture Website Link)

Consider any adverse impact to cultural resources when planning for aquaculture ponds.

The visual design of ponds should be carefully considered in areas of high public visibility and those associated with recreational fishing.

Consider the effects on the volume of downstream flow or aquifers that might cause undesirable environmental, social, or economic effects and contribute to water table decline from heavy pumping.

Measures to avoid depredation by birds or other animals should be included in the design.

The soils within the pond area, as well as those in the contributing drainage area, must be checked for residues of pesticides and other harmful chemicals if there is any possibility of contamination.

Landowners should give careful consideration to sites proposed for impoundment construction. Areas considered for construction should not have accumulated pesticides or other chemical residues in the soil at levels which are toxic to fish.

Adjacent land use should also be considered if runoff from those areas is to be permitted to enter the impoundment. Agricultural associated pollutants pose major problems for commercial fish production.

Consider the amount of available area for expansion of facilities if needed.

PLANS AND SPECIFICATIONS

Plans and specifications for constructing aquaculture ponds shall be in keeping with this standard and shall describe the site-specific requirements for applying the practice to achieve its intended purpose.

At a minimum the following will be identified (as appropriate):

- ***Species and stocking rate;***
- ***pond type (embankment or excavated) size and depth(s);***
- ***description of water source/supply, pH and volume available;***

- ***any required permits to be obtained by the landowner prior to installation of this practice;***
- ***any required environmental evaluations including but not limited to the WVCPA-052;***
- ***designs, drawings and specifications of any component structures or facilities required to implement this practice including filter and screen designs; and***
- ***Any site descriptions or reports available from technical specialists including, but not limited to soils information, hydrology studies, fishery studies, economic feasibility reports, water chemistry and water quality test results, etc.***

OPERATION AND MAINTENANCE

A plan for operation and maintenance shall be prepared for use by those responsible for the system.

Plans for operation and maintenance shall provide for inspection, operation, and maintenance of vegetation, pipes, valves, spillways, roads, and other parts of the system.

Species management shall be in accordance with West Virginia Conservation Practice Standard (399) Fishpond Management or other appropriate material prepared by aquaculture specialists.

REFERENCES

Gindice, John J., D. Leroy Gray, and J. Mayo Martin. "Manual for Bait Fish Culture in the South." EC550 University of Arkansas: Cooperative Extension Service. 49 pp.

Lee, Jasper S. 1973. Commercial catfish Farming. Interstate Printers & Publishers, Inc., Danville, 11. 263 pp.

The WVU Extension Service – Aquaculture Website
1052 Agricultural Sciences Building, P.O. Box 6108, Morgantown, WV 26506-6108
http://www.wvu.edu/~agexten/aquaculture/index.htm

APPENDIX I

NATURAL RESOURCES CONSERVATION SERVICE
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LIST OF POTENTIAL PERMITS, FEES & CONTACTS

Activity	Permit	Fee	Contacts
Fish Processing Facility	Processing License Enrollment in Inspection Program	Varies	W.Va. Department of Agriculture; Aquaculture Inspector, (304) 558-2226
	NPDES Permit	Based on volume of discharge	Division of Environmental Protection; Chief of Water Resources (304) 558-2107
Importation of eggs, fingerlings or fish from out of State*	Fish Importation Permit	None	Division of Natural Resources; Wildlife Resources Section (304) 558-2771
Food Fish Production	Enrollment in Inspection Program	None	W.Va. Department of Agriculture; Aquaculture Inspection (304) 558-2226
Fish Production	Fish Pond License Fish Sellers License	$10 $10	Division of Natural Resources Law Enforcement Section (304) 558-2784
Fish Production over 20,000 lbs per year or 5,000 lbs of feed per month (ONLY WHEN REQUIRED BY A WVDEP INSPECTOR)	NPDES Permit	$250 upon application, annual based on maximum feed per month	Division of Environmental Protection; Chief of Water Resources (304) 558-2107
Fee Fishing Operation	Commercial Fishing Preserve License	$25/year	Division of Natural Resources; Law Enforcement Section (304) 558-2784
Bait Fishing Production	DNR Permit(s)	Varies	Division of Natural Resources; Law Enforcement Section (304) 558-2784

*Certified disease-free letter from out-of-state supplier required in addition to fish importation permit when importing salmonids into the following counties: Berkeley, Braxton, Fayette, Grant, Greenbrier, Hampshire, Hardy, Jefferson, Mercer, Mineral, Monroe, Morgan, Nicholas, Pendleton, Pocahontas, Preston, Randolph, Tucker, and Webster.